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LOBLOLLY PINE RELEASE STUDY

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LOBLOLLY PINE RELEASE
Report #19
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ABSTRACT

This study included three treatments in which basal spraying, using two different concentrations of 2,4,5-T, was compared to no release. Basal spraying was done in the winter, following the second growing season in the field. Hardwood competition was severe. At age 18, 1:40 plots averaged 54 percent more basal area and 67 percent more volume in standard cords than check plots, and 1:20 plots averaged 76 percent more basal area and 103 percent more volume in standard cords than check plots. Cordwood yields were related to both hardwood basal area measured at age 18 (r^2 = .908) and a free-to-grow index estimated at age 3 (r^2 = .884).

INTRODUCTION

This is the nineteenth in a series of Occasional Reports concerning release of loblolly pine seedlings from hardwood competition. This study was installed on the privately-owned Faulconer tract in Orange County, in the central Piedmont of Virginia. The previous stand was hardwood, predominantly oak. The site was prepared by prescribed-burning during the summer of 1969, and it was planted in February of 1970. Basal spraying was done on January 24, 25, and 26, 1972, after two growing seasons in the field. Three swaths, each two chains wide and ten chains long, were established (Figure 1). One swath was basal sprayed using a 1:40 dilution of 2,4,5-T in fuel oil and another swath was basal sprayed using a 1:20 dilution, leaving the third swath unsprayed as a control. The 2,4,5-T contained four pounds of active ingredient per gallon.

The remainder of the tract, surrounding the release study on three sides, was aerially released about five years after planting. The pilot was instructed to avoid the release study, but considerable "drift" damage occurred over the entire study area. This was especially noticeable on the control swath, located between the two basal-sprayed swaths. Leaders were killed back on all hardwood species. This drift damage was still obvious when the second measurement was made at age 10. The check plots probably benefited more than the basal-sprayed plots, so that the yield differences reported here are probably somewhat conservative.

GROWTH PLOT INSTALLATION

Plots were installed at age 3, during the winter following basal spraying. Nine 1/10-acre plots were installed, three in each swath (Figure 1). Hardwood competition was severe on most of the study area. Volunteer Virginia pine and shortleaf pine seedlings were pulled up when the plots were installed.

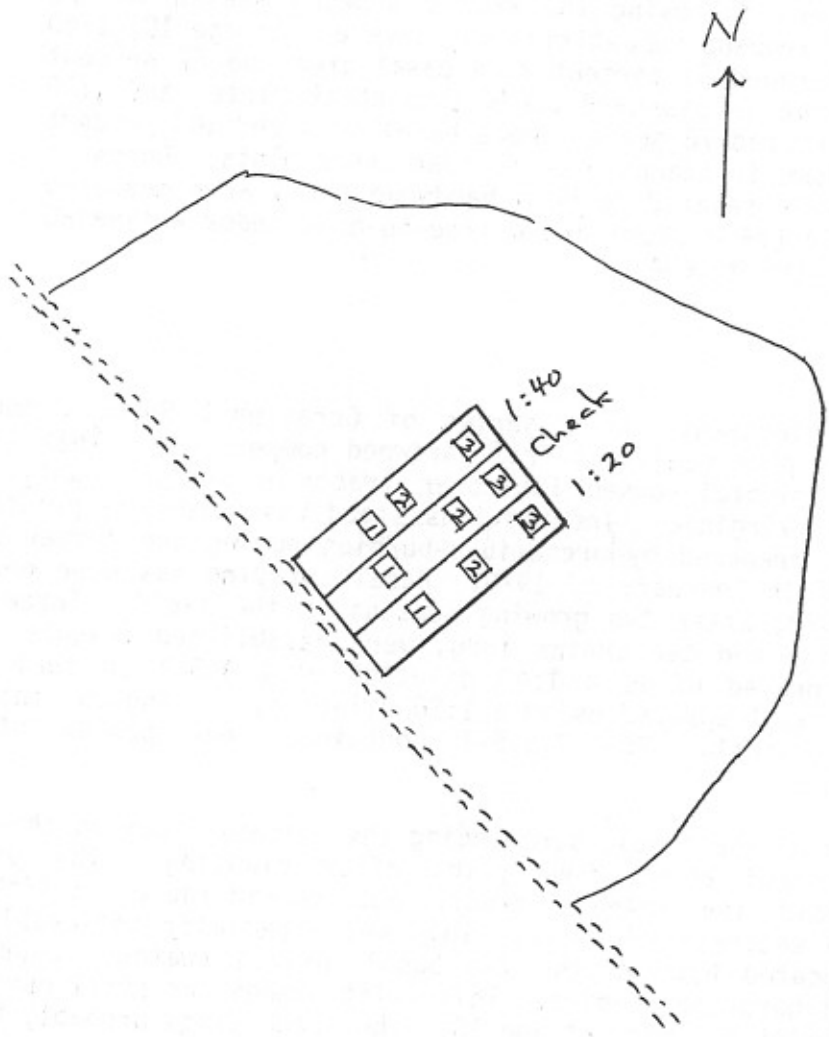

Figure 1. Layout of growth plots.

Measurements were made at age 3, when the plots were established, and at ages 10, 14, and 18. At age 3, all loblolly pine seedlings were measured for height to the nearest foot, and classified as to free-to-grow status, using a four part classification system.1/ At later measurements, diameter at breast height of each loblolly pine was measured to the nearest inch, and a sample of trees in each diameter class was measured for total height to the nearest foot, noting which trees were dominant or codominant. For the final measurement at age 18, all hardwoods over .5 inch DBH were tallied by species, 1-inch diameter class, and crown class. Total height to the nearest foot was measured on 60 percent of the intermediate, 90 percent of the codominant, and all of the dominant hardwoods.

RESULTS AND DISCUSSION

A summary of loblolly pine data for the four measurements is presented in Table 1. At age 18, 1:40 plots averaged 9.0 standard cords per acre and 1:20 plots averaged 13.8 standard cords per acre more than check plots.2/ Differences due to release increased with time (Table 2). Table 3 presents stand tables for loblolly pine at age 18.

A summary of average hardwood data at the final measurement at age 18 is presented in Tables 4 and 5, and individual plot data is presented in Table 6. Although there were almost as many hardwoods on the released plots as on the check plots, there were considerably more large hardwoods on the check plots. This was reflected in differences in hardwood basal area. The check plots had almost twice as much hardwood basal area as the 1:40 plots and over three times as much as the 1:20 plots.

There were a total of six dominant and 20 codominant hardwoods on the three check plots (87 per acre), five codominant hardwoods on the three 1:40 plots (17 per acre), and no codominant or dominant hardwoods on the three 1:20 plots. All of these dominant and codominant hardwoods are either chestnut oak or scarlet oak, with chestnut oak predominating. The chestnut oak ranged from 32 to 50 feet tall, averaging 42 feet, and the scarlet oak ranged from 35 to 45, averaging 40 feet. All six of the released plots and check plot 3 should end up eventually with pure loblolly pine in the canopy. However, check plots 1 and 2 will end up with considerable hardwood--perhaps one-half hardwood on check plot 2 and one-third hardwood on check plot 1.

1/ See Occasional Report No. 78 (Release Report No. 11) for a description and discussion of this classification system.

2/ Standard cords at age 18 were subjected to an analysis of variance for randomized blocks (caution should be used in interpreting the results of this analysis, because treatment plots could not be truly randomized). The probability of a larger overall F for treatments was .051. Duncan's New Multiple Range Test was used to test for differences between treatment means. Average yields on 1:20 plots were significantly greater than on check plots (.05 level), but average yields on 1:40 plots were not.

Table 1. A summary of loblolly data at ages 3, 10, 14, and 18: number of trees per acre, average DBH, basal area per acre, standard cords per acre, and average height of dominant and codominant trees.*

	Check Plots						1:40 Plots						1:20 Plots				
Age	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.	Plot	No.	DBH	B.A.	Cds.	Ht.
3	1	500	-	-	-	5.9	1	560	-	-	-	5.2	1	640	-	-	-	4.6
	2	390	-	-	-	4.6	2	540	-	-	-	5.2	2	480	-	-	-	5.5
	3	390	-	-	-	5.6	3	390	-	-	-	5.0	3	440	-	-	-	5.3
Means		427	-	-	-	5.4		497	-	-	-	5.1		520	-	-	-	5.1
10	1	470	4.26	49.6	-	28.6	1	550	4.79	76.0	-	29.5	1	640	4.70	81.0	-	28.0
	2	370	3.34	28.0	-	26.9	2	540	4.79	70.1	-	29.2	2	480	5.69	87.4	-	29.8
	3	390	4.44	46.4	-	26.9	3	390	4.92	56.2	-	29.3	3	430	5.77	80.0	-	30.2
Means		410	4.01	41.3	-	27.5		493	4.83	67.4	-	29.3		517	5.39	82.8	-	29.3
14	1	420	5.14	64.4	7.3	35.3	1	530	5.79	104.6	15.7	39.1	1	630	5.54	110.4	13.5	36.5
	2	320	4.48	41.5	4.5	34.3	2	540	5.57	97.4	13.0	37.6	2	470	6.79	122.6	20.9	41.0
	3	390	5.51	71.7	9.3	36.0	3	380	6.08	83.3	12.5	39.0	3	430	6.93	116.3	18.8	39.7
Means		377	5.04	59.2	7.0	35.2		483	5.81	95.1	13.7	38.6		510	6.42	116.4	17.7	39.1
18	1	380	6.03	79.2	13.1	44.5	1	510	6.63	129.9	25.3	46.6	1	570	6.21	126.5	22.4	46.2
	2	270	5.89	55.5	9.6	43.9	2	520	6.38	122.9	22.4	45.2	2	450	7.51	143.9	31.4	50.4
	3	360	6.78	96.2	17.5	45.9	3	360	7.06	103.8	19.6	45.1	3	430	7.49	136.8	27.7	47.6
Means		337	6.23	77.0	13.4	44.8		463	6.69	118.9	22.4	45.6		483	7.07	135.7	27.2	48.1

*Except at age 3, where heights presented are for all trees.

Table 2. Average differences between check and released plots at each measurement, for basal area and standard cords per acre.

	1:40 minus Check		1:20 minus Check	
Age	Basal Area	Std. Cds.	Basal Area	Std. Cds.
10	26.1	-	41.5	-
14	35.9	6.7	57.2	10.7
18	41.9	9.0	58.7	13.8

Table 3. Average number of loblolly pine per acre by diameter class at age 18.

DBH	Check Plots	1:40 Plots	1:20 Plots
2	7	10	0
3	13	17	13
4	27	27	30
5	57	47	27
6	83	83	97
7	70	133	136
8	50	93	96
9	27	43	57
10	3	10	27
Totals	337	463	483

Table 4. Average numbers of hardwoods per acre by species and diameter class at age 18.

Check Plots

Species	DBH 1	2	3	4	5	6	Totals
Chestnut oak	233	133	155	74	46	27	668
White oak	13	7	13	3			36
Red oak	183	63	23	20	10	3	302
Blackgum	274	13					287
Bigtooth aspen	17	3	10	3			33
Red maple	43	17	3				63
Hickory	103	7					110
Black cherry	3		7				10
Sassafras	47						47
Dogwood	7						7
Blackhaw	7						7
Totals	930	243	211	100	56	30	1,570

1:40 Plots

Species	DBH 1	2	3	4	5	6	Totals
Chestnut oak	464	104	50	63	14	6	701
White oak	67	3			3		73
Red oak	253	3	4		7		267
Blackgum	247	7					254
Bigtooth aspen	43	3					46
Red maple	10		3				13
Hickory	67						67
Black cherry	13	7			3		23
Sassafras	30						30
Dogwood	3						3
Yellow-poplar	10	3	3				16
Holly	7						7
Totals	1,214	130	60	63	27	6	1,500

1:20 Plots

Species	DBH 1	2	3	4	Totals
Chestnut oak	200	40	7		247
White oak	87	7			94
Red oak	296	63	3		362
Blackgum	270				270
Bigtooth apsen	77	27	7	7	118
Red maple	10				10
Hickory	150	13			163
Black cherry	10	7			17
Sassafras	33				33
Dogwood	87	20			107
Yellow-poplar	7	23	3		33
Totals	1,227	200	20	7	1,454

Table 5. Average numbers of hardwoods per acre by diameter class and crown class, and basal area by crown class, at age 18.

Check Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	930				930
2	243				243
3	97	114			211
4		83	17		100
5		13	40	3	56
6		3	10	17	30
Totals	1,270	213	67	20	1,570
B.A.	15.1	15.2	8.9	3.7	43.0

1:40 Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,214				1,214
2	130				130
3	47	13			60
4	3	57	3		63
5	3	14	10		27
6		3	3		6
Totals	1,397	87	16		1,500
B.A.	12.4	8.1	2.2		22.8

1:20 Plots

DBH	Over-topped	Intermediate	Codominant	Dominant	Totals
1	1,227				1,227
2	197	3			200
3	13	7			20
4		7			7
Totals	1,437	17			1,454
B.A.	11.6	1.0			12.6

Table 6. Numbers of hardwoods by diameter class and crown class, and basal area by crown class, on each 1/10-acre plot.

Check - # 1

DBH	O	I	CD	D	Totals
1	106				106
2	19				19
3	11	10			21
4		7	3		10
5			5		5
6		1	1	1	3
Totals	136	18	9	1	164
B.A.	1.53	1.30	1.14	.20	4.17

Check - #2

DBH	O	I	CD	D	Totals
1	84				84
2	27				27
3	9	13			22
4		9	2		11
5		1	6	1	8
6			2	4	6
Totals	120	23	10	5	158
B.A.	1.49	1.56	1.38	.92	5.36

Check - #3

DBH	O	I	CD	D	Totals
1	89				89
2	27				27
3	9	11			20
4		9			9
5		3	1		4
Totals	125	23	1		149
B.A.	1.52	1.73	.14		3.39

1:40 - #1

DBH	O	I	CD	D	Totals
1	96				96
2	20				20
3		1			1
4		5			5
5	1	3			4
6					
Totals	117	9			126
B.A.	1.10	.89			1.99

1:40 - #2

DBH	O	I	CD	D	Totals
1	133				133
2	10				10
3	4				4
4	1	10			11
5					
6		1	1		2
Totals	148	11	1		160
B.A.	1.23	1.07	.20		2.49

1:40 - #3

DBH	O	I	CD	D	Totals
1	135				135
2	9				9
3	10	3			13
4		2	1		3
5		1	3		4
Totals	154	6	4		164
B.A.	1.42	.46	.50		2.38

1:20 - #1

DBH	O	I	CD	D	Totals
1	159				159
2	27	1			28
3	2	2			4
4					
Totals	188	3			191
B.A.	1.55	.12			1.67

1:20 - #2

DBH	O	I	CD	D	Totals
1	123				123
2	17				17
3	1				1
4		1			1
Totals	141	1			142
B.A.	1.09	.09			1.18

1:20 - #3

DBH	O	I	CD	D	Totals
1	86				86
2	15				15
3	1				1
4		1			1
Totals	102	1			103
B.A.	.84	.09			.93

Cordwood yields of loblolly pine at age 18 were related to the amount of hardwood present. Figure 2 shows pine cordwood yields related to hardwood basal area at age 18, for the nine plots. A simple linear regression fitted to these data accounted for 91 percent of the variation in cordwood yields.3/

Cordwood yields also correlated well with the average free-to-grow index for each plot at age 3. Table 7 shows the percent of trees in each free-to-grow class for each plot, at age 3. In Figure 3, pine cordwood yields at age 18 are plotted over average free-to-grow index at age 3 for each plot. A simple linear regression fitted to these data accounted for 88 percent of the variation in cordwood yields.4/

Dominant and codominant loblolly pine have grown faster on the released plots than on the check plots (Table 1). Comparing 1:40 plots to check plots, average height differences were -.3, 1.8, 3.4, and .8 feet at ages 3, 10, 14, and 18, respectively. Comparing 1:20 plots to check plots, average height differences were -.3, 1.8, 3.9, and 3.3 feet at ages 3, 10, 14, and 18, respectively. There is nothing to suggest that site index should be higher on the released swaths than on the check swath. Hardwood competition seems to have affected height of dominant and codominant pines, as we have noticed in other release studies.5/ A plotting of average dominant and codominant height of loblolly pine at age 18 over hardwood basal area for all nine plots shows a significant relationship between pine height and hardwood competition (Figure 4).6/ The relationship between dominant and codominant height of loblolly pine and the free-to-grow index estimated at age 3 was almost as strong .7/

3/ Estimated standard cords = 32.89 - .4544 (hardwood basal area), r^2 = .908, probability of a larger F = .00007.

4/ Estimated standard cords = 46.16 - 13.454 (free-to-grow index at age 3), r^2 = .884, probability of a larger F = .0002.

5/ See Occasional Report No. 75 (Release Report No. 8) for a discussion of this relationship and its probable cause.

6/ Estimated pine height = 48.87 - .1038 (hardwood basal area), r^2 = .599, probability of a larger F = .014.

7/ Estimated pine height = 51.81 - 3.0227 (free-to-grow index at age 3), r^2 = .564, probability of a larger F = .020.

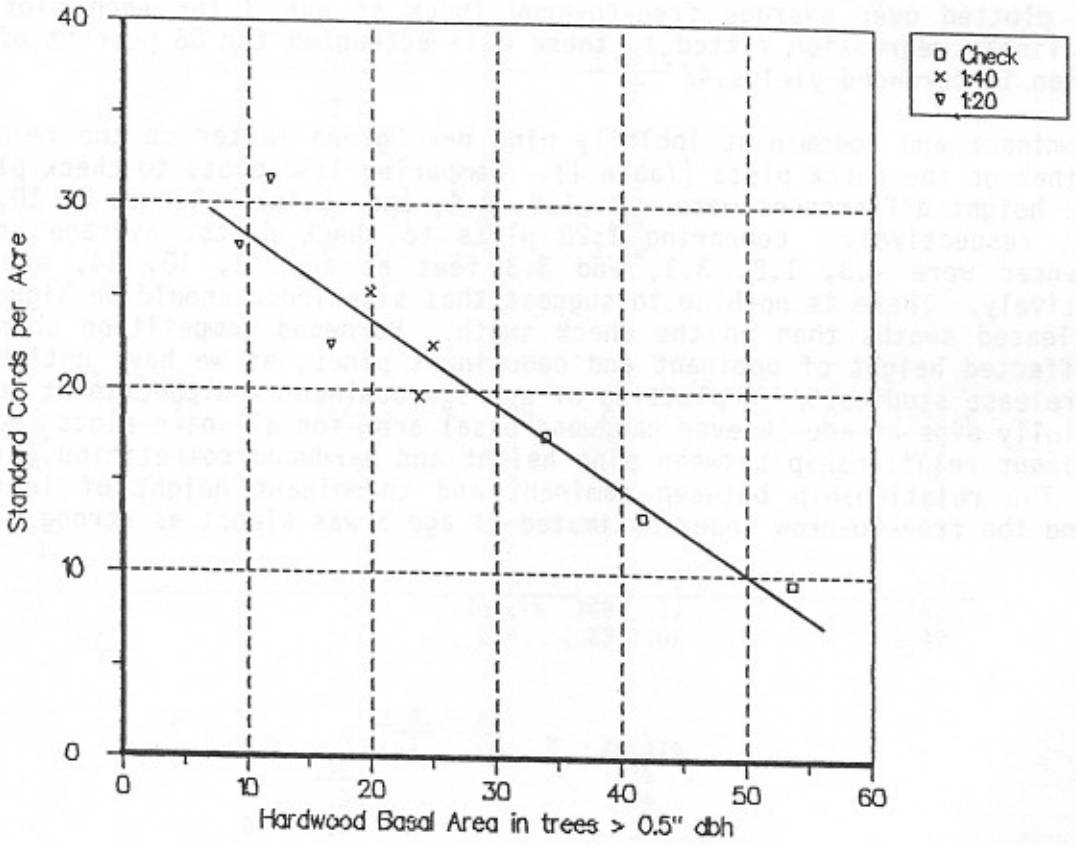

Figure 2. Pine cordwood yields at age 18 related to hardwood basal area.

Table 7. Percent of trees by free-to-grow class for each plot, at age 3.

		Free-to-grow Status				
	Plot	1	2	3	4	Means
Check	1	7	63	16	14	2.37
	2	3	55	14	28	2.66
	3	6	65	19	10	2.32
	Means	5	61	16	17	2.45
1:40	1	40	49	7	4	1.76
	2	55	42	2		1.48
	3	28	56	9	6	1.94
	Means	41	49	6	3	1.73
1:20	1	46	50	4		1.58
	2	73	27			1.27
	3	60	36	5		1.45
	Means	60	38	3		1.43

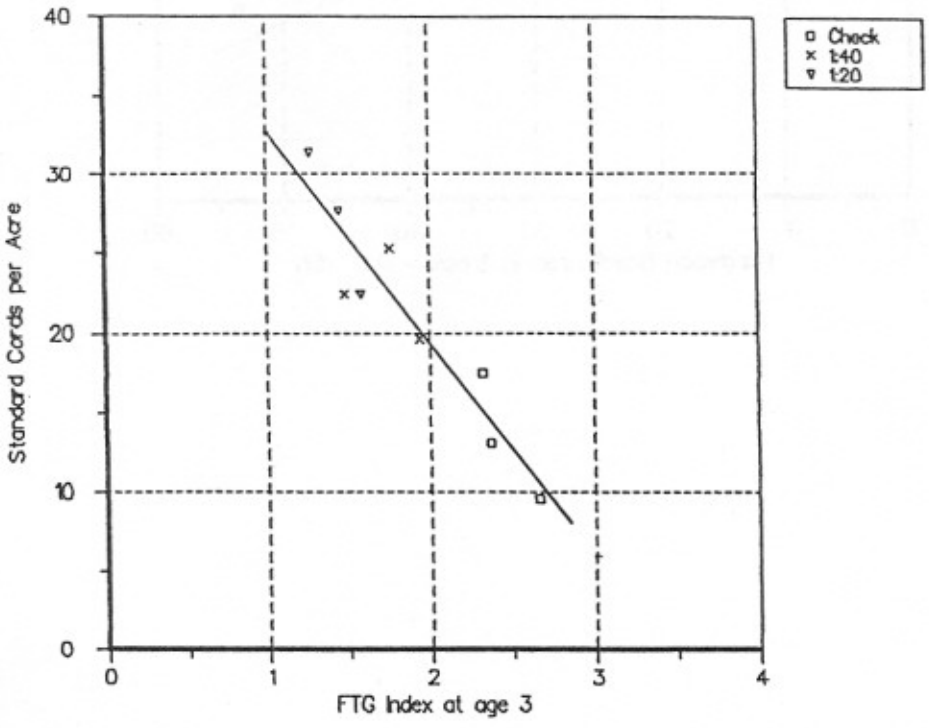

Figure 3. Pine cordwood yields at age 18 related to FTG index.

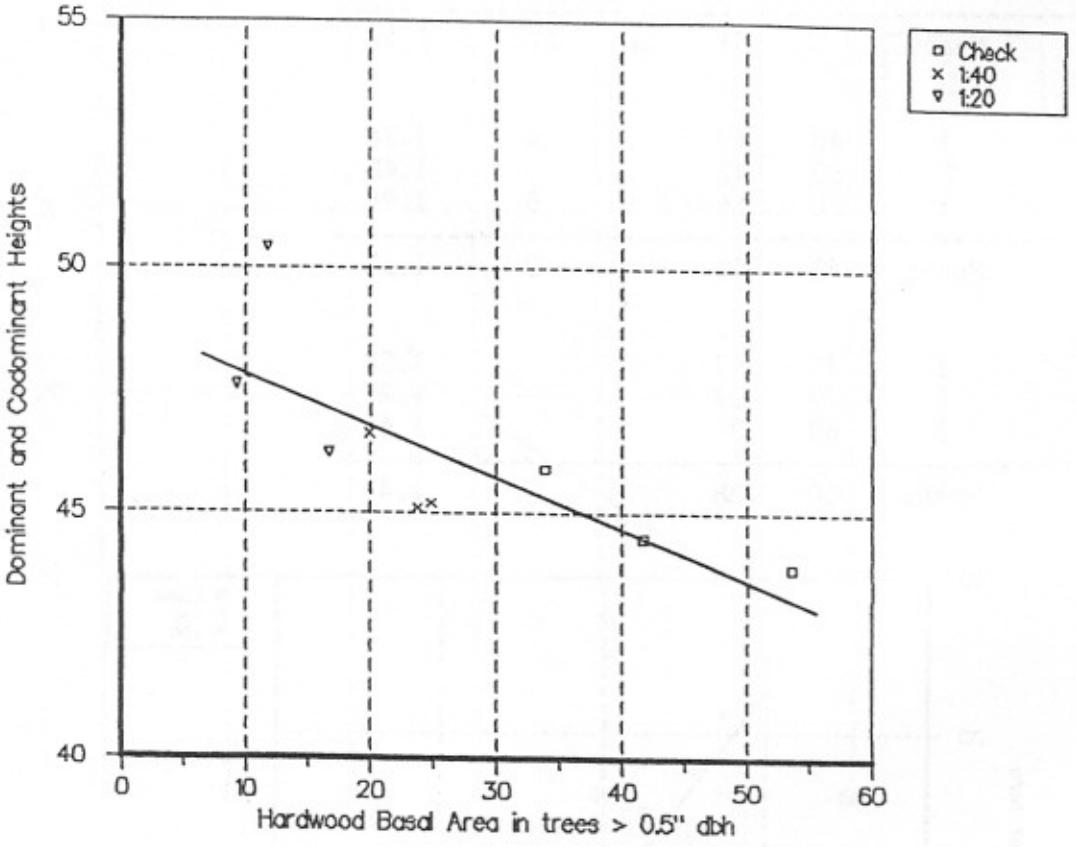

Figure 4. Pine dominant and codominant height at age 18 related to hardwood basal area.